Space Weather Technical Forecast

Issued on Tuesday, 16 April 2024 at 01:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance G1 day 2, 3 & 4 (17-19 Apr). M-flares likely, slight chance of X-flares.

Solar Activity: Moderate with eight low level M-class flares in the past 24 hours, all from AR3639 and 3634. The largest was an M4.0 at 15/1932UTC from AR3639. There are ten sunspot regions currently visible on the disk. AR3634 in the northwest is the largest spot on the disk and one of the most complex with a beta-gamma configuration, however, it has lost its delta. AR3639 in the northeast is another complex spot with a beta-gamma-delta configuration, and evidence of increasing length and area as it rotates into a less oblique viewing angle. AR3637 in the southeast retains its apparent small delta spot. Recently numbered AR3643 in the southeast continues to emerge around the limb, currently with a beta-gamma configuration. All other spots are smaller and simple.
Two CMEs were observed, the first leaving the northeastern quadrant of the Sun early 15th Apr, analysis suggests this may impact Earth late on the 17th or early 18th April, the second off the northwest later in the day with further analysis needed.

Solar Wind / Geomagnetic Activity: Solar winds as observed by ACE at L1 were slow-ambient, around 330 km/s, a sudden increase around 15/1730UTC to 360km/s may indicate a weak CME arrival. Density was below average before increasing to average following the CME arrival. Interplanetary magnetic field (IMF) strength, Bt, remained weak below 5nT until it increased to moderate 8-10nT after the CME. The north-south component, Bz, also only varying weakly, though fell to -9nT at times after the CME arrival. Phi angle was mostly negative (towards the Sun). Despite the CME resultant geomagnetic activity was Quiet (Kp 1-2) with one Unsettled (Kp3) interval between 15/2100-2359UTC.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) observed at GOES18 was at Background. High energy electron flux (greater than 2MeV) observed at GOES16 was Background to Moderate, with a peak of 387pfu observed at 15/1825 UTC. The associated 24-hour fluence remained below Active (1e8 integrated flux) with a value of 7.39e6 integrated pfu observed at 15/2359 UTC.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate solar activity is likely, with further M-class flares, these probably originating from spots in the northern hemisphere. There is a slight chance of activity becoming High should any isolated X-class flares occur.

Solar Wind / Geomagnetic Activity: There are up to two CMEs, with the potential for Earth-directed components. The first is from a joint C5.0 flare and filament eruption on 14 Apr, which may give a glancing blow on 17 Apr. The second from a CME early on the 15th may arrive later on the 17th or early on the 18th. Otherwise, no coronal hole fast winds are expected for most of the period, with speeds likely background or perhaps slightly elevated. A fast wind from CH25/- is expected to arrive on the 20th.
Geomagnetic activity is expected to be generally Quiet to Unsettled through the 4 day period. There remains a chance of Active or G1/Minor storm periods on days 2 and 3 (17-18 Apr) from low confidence CME arrivals.

Energetic Particles / Solar Radiation: High energy proton flux as observed by GOES18 is expected to persist at Background. High energy electron flux as observed by GOES-16 is expected to remain at background to moderate levels. The associated 24 hr electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold.

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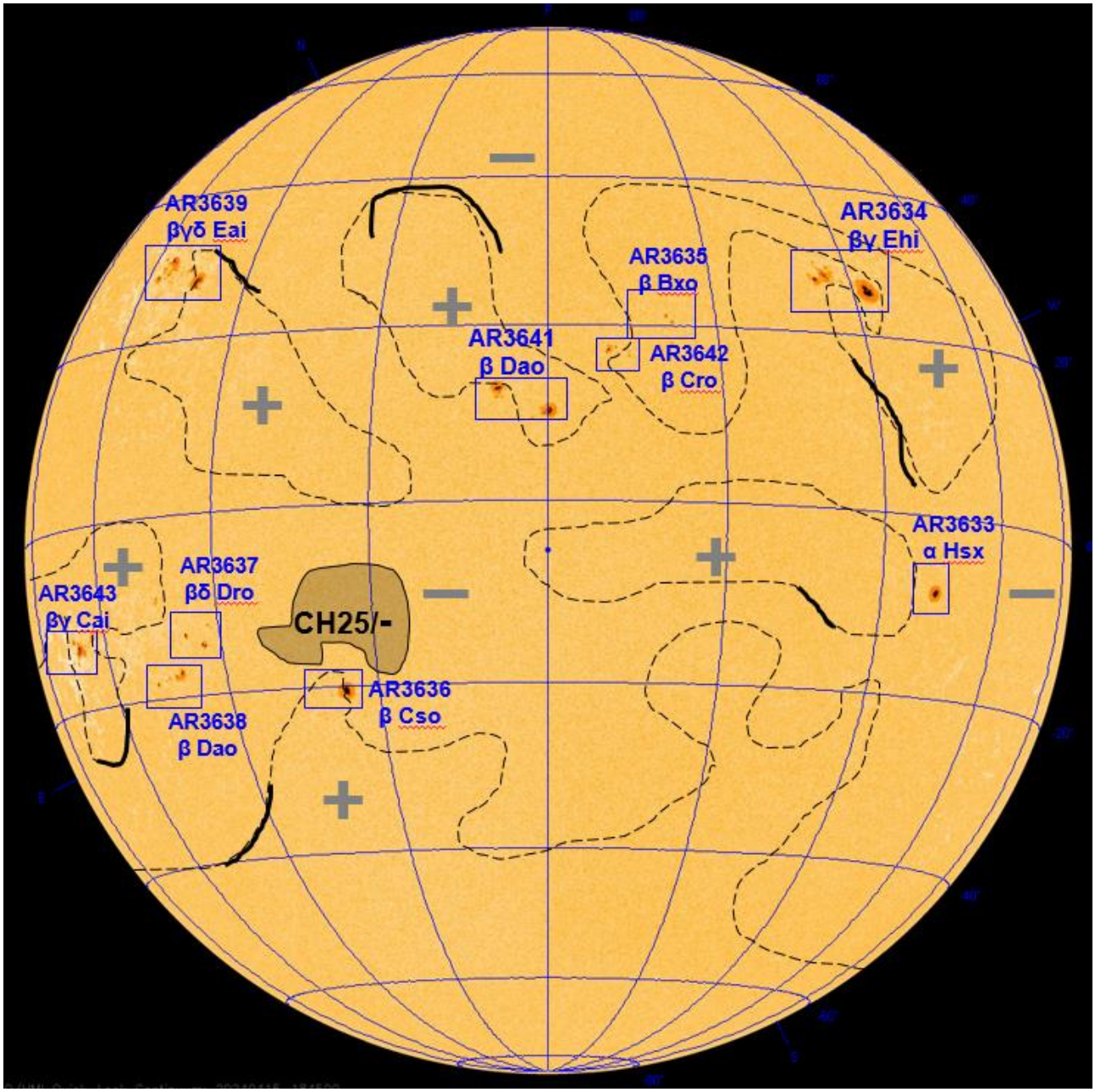
Figure 1. Solar Analysis Valid *.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are up to two CMEs, with the potential for Earth-directed components.
The first was from a joint C5.0 flare and filament eruption of AR3636 in the southeast disc on 14 Apr. Analysis has returned a potential glancing blow at Earth, most likely on day 2 (17 Apr).
The second was associated with a CME eruption which left the northeastern quadrant of the Sun around 15/0549UTC. Enlil suggests this could impact Earth later on the 17th or early on the 18th.
No coronal hole fast winds are expected through the period, with the HSS from CH25/- expected to arrive on the 20th.
Geomagnetic activity is expected to be generally Quiet to Unsettled through the 4 day period.
There remains a chance of Active or G1/Minor storm periods on day 2 or day 3 (17-18 Apr) from low confidence CME arrivals.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	5	30	30	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
14/1553	Partial	C5 flare + Filament	SE	680 km/s	17/0900 UTC +/-6 hrs	Glancing impact
15/0549	Partial	Filament	SE	640 km/s	18/0600 UTC +/- 6 hrs	Low confidence

Figure 2: MOSWOC Enlil

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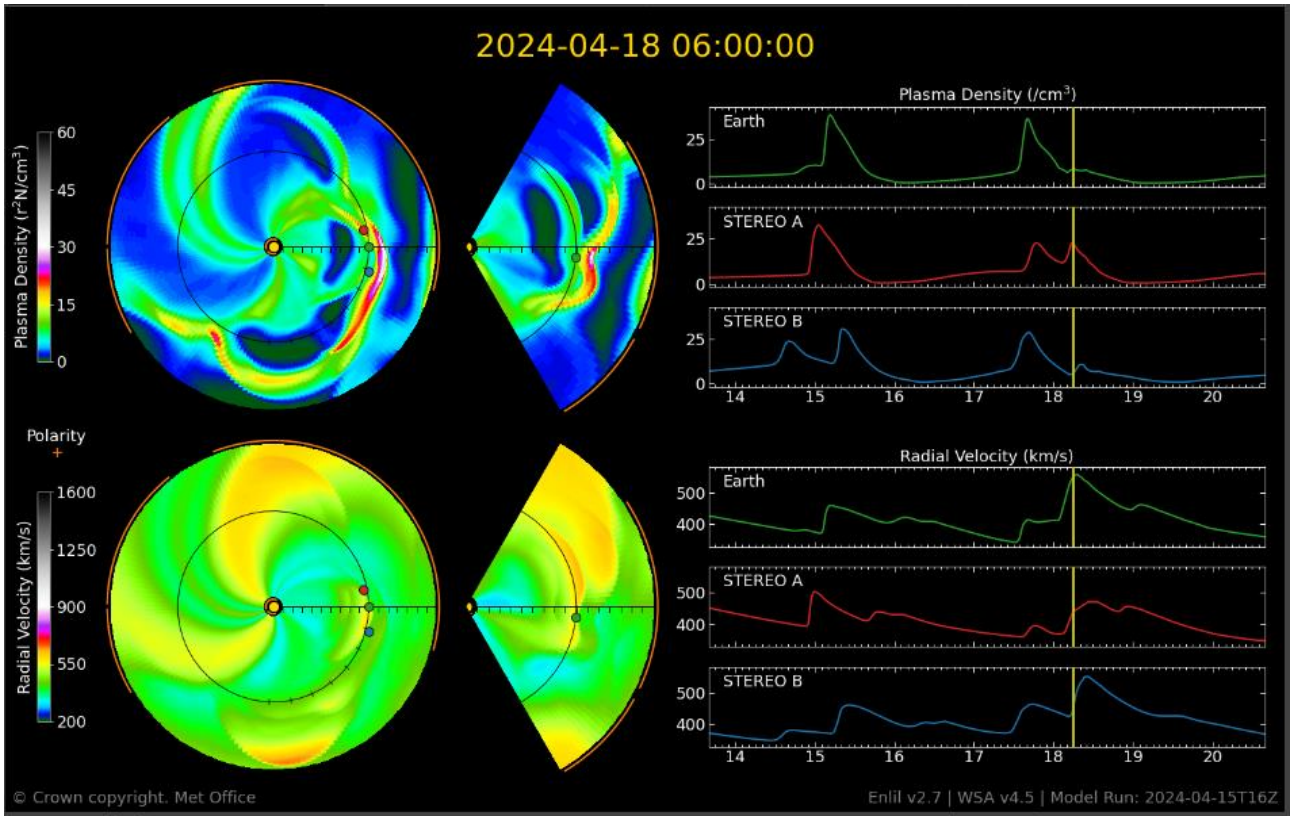

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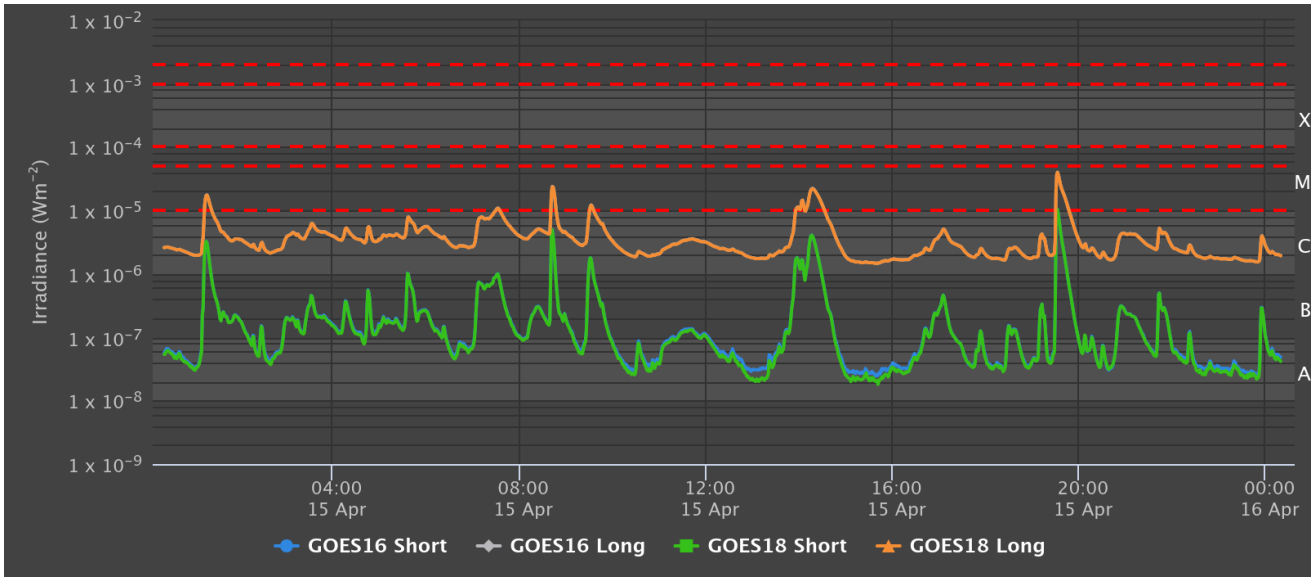
Radio Blackouts - X-Ray Flares:
Moderate activity is likely to continue with a slight chance of becoming High. Overall, activity continues on an upward trend with ten sunspot regions now on the disc, background flux is well within C-class levels.
The significant flares have originated from AR3639 or 3634, both in the northern hemisphere. There are ten sunspot regions currently visible on the disk. AR3634 in the northwest is the largest and one of the most complex, though it has lost its delta spot. AR3639 is another complex spot, again with a small delta spot in its trailing region, this is becoming increasingly evident as it rotates further into view. AR3637 in the southeast retains its apparent small delta spot within the leading portion, but compared to the aforementioned spots it is much smaller with a simpler magnetic structure. Recently numbered AR3643 in the southeast continues to rotate into a more favourable viewing angle, currently with a beta-gamma configuration. All other spots are smaller and simple. 3632 has rotated off the west limb.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	70	70	70	70
Very Active	R3 to R5 X Class	No	15	15	15	15

Figure 3: GOES18 X-Ray flux



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux as observed by GOES18 has persisted at Background. There is a very slight chance of the observed flux increasing in response to any notable flares, primarily from AR3634 with this region moving towards the western limb through the period.

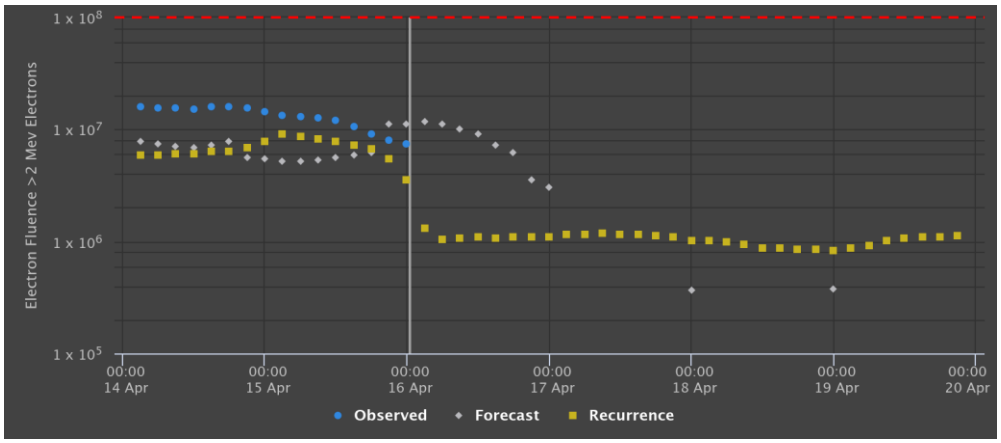
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux as observed by GOES-16 remains at background to moderate levels and is expected to remain so, or reduce given the lack of charging events expected at Earth. The associated 24 hr electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold, as supported by REFM.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REF Model



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